DEPARTMENT OF NOTES. REVIEWS, ETC.

It is the purpose, in this department, to present from time to time brief original notes, both of methods of work and of results, by members of the Society. All members are invited to submit such items. In the absence of these there will be given a few brief abstracts of recent work of more general interest to students and teachers. There will be no attempt to make these abstracts exhaustive. They will illustrate progress without attempting to define it, and will thus give to the teacher current illustrations, and to the isolated suggestions of suitable fields of investigation.—[Editor.]

ENTOMOLOGICAL NOTES

Collembola.—Folsom ('16, Proc. U. S. Nat. Mus., 50:477-525) presents a paper treating of all of the known species of North American *Poduridæ (Collembola),* with the exception of the subfamily *Onychiurinæ.* Keys to all of the taxonomic groups and full descriptions of the species are features of the paper. A bibliography of one hundred seventeen titles, and eighteen plates containing two hundred fifty figures, add to the value of the work. It is a paper indispensable to persons interested in the *Collembola.*

Pure Lines in Aphids.—Ewing ('16, Biol. Bull., 31:53-112), in a paper entitled "Eighty-seven Generations in a Parthenogenetic Pure Line of Aphis avenæ Fab.", finds no summation effect by selection, using six different fluctuating variations, and is of the opinion that summation through continued selection is not to be expected since fluctuations in such a pure line "are in general not dependent upon germinal variations." Selection from extreme variants was without effect on somatic characters of succeeding generations. Long continued selection from the extreme variant in each succeeding generation produced no more change in the mode of the variable than did the selection from individuals differing but slightly from the mean of the line and for only a few generations. Nor was the mean of the line shifted when selections from extreme variants for forty-four successive generations were made, using a character (body-length) "which is known to be inherited in the higher animals that reproduce sexually." Variations in body-length were found to be largely due to variations in temperature and food. The rarely appearing discontinuous variations were apparently not inherited. Size, fecundity, and color were not affected by long continued parthenogenetic reproduction. Pædogenesis occurred occasionally

among the nymphs of both winged and wingless forms and the offspring which reached maturity were normal. It is thought that pædogenesis in this aphid is due to "the arrested development of the body in general, while the reproductive organs become completely functional."

Insect Flagellates and Disease.—Fantham and Porter ('16, Journ. Parasitology, 2:149-166) have studied "the significance of certain natural flagellates of insects in the evolution of disease in vertebrates." Flagellates, including members of the genera *Herpetomonas* and *Crithidia,* secured from the alimentary tracts of several species of insects, were introduced into representatives of the *Pisces, Amphibia, Reptilia, Aves,* and *Mammalia,* by inoculation or by feeding. The latter was accomplished by feeding the host with the infected insects, or with the intestines of the insects, or with food contaminated with the feces of insects containing the resistant stages of the *Flagellata* concerned. It was found by these methods that *herpetomoniasis* can be induced in various warm and cold-blooded vertebrates, the nature of the infection and the protozoan parasites found in the vertebrate hosts resembling those of human and canine *leishmaniases. Herpetomonas jaculum, H. stratiomyiæ, H. pediculi, H. ctenocephali, H. culicis,* and *Crithidia gerridis* were found pathogenic to warm-blooded vertebrates, the first and last mentioned having been also successfully introduced into cold-blooded hosts, such as fishes, frogs, toads, lizards, and grass-snakes. In acute cases of the induced disease, the flagellate form of the parasite was most numerous at the death of the host, while in chronic cases the non-flagellate forms predominated. These writers hold that a *Leishmania* is morphologically a *Herpetomonas,* that *leishmaniases* are invertebrate-borne *herpetomoniases,* "and that these maladies have been evolved from flagellates of invertebrates (especially insects) which have been able to adapt themselves to life in vertebrates."

Phylloxera Galls.—Rosen ('16, Am. Journ. Botany, 3:337-360) finds that the leaf-gall produced by *Phylloxera vastatrix,* which occurs on *Vitis vulpina,* starts to develop on the embryonic bud leaves and soon produces a depression due to the upward growth of tissue at the sides. That portion of the leaf surrounding the proboscis and beneath the insect shows no proliferation.

Gall development depends upon leaf development, the gall becoming mature when the leaf reaches maximum size. No support for the theory that the insect causes gall formation by the injection of some chemical appears in this study. The initial stimulus for gall development is believed to be the continuous sucking action of the insect at a single fixed point.

Color Inheritance in Phasmidæ.—MacBride and Jackson ('15, Proc. Royal Soc. London, (B) 89:109-118) have studied the inheritance of color in a phasmid, *Carausius morosus,* from southern India, which exhibits marked color varieties. Of the several thousand insects reared, only six males and one gynandromorph appeared, the results therefore being concerned with parthenogenetic inheritance. All the insects are alike at hatching, having a definite color pattern of green and brown pigments. In subsequent growth, the green pigment overpowers the brown so that the insect appears pure green in the majority of cases, although, in about three per cent., the reverse occurred. The color of the mother does not influence the proportion of predominantly green or predominantly brown offspring. Pure green forms were secured from larvæ reared in complete darkness. Conditions of reduced light did not increase the proportion of brown forms. Males are very rarely produced from the eggs of unfertilized females.

Cuticula vs. Parasites.—Thompson ('15, Proc. Cambridge Philosoph. Soc., 18:51-55) presents argument and data in support of "the cuticula of insects as a means of defence against parasites." Some of the positive points stressed are: (1) Thickness and resistance of the cuticula sometimes effectively prevent the entrance of dipterous parasites. (2) In the process of molting, the larvæ of insects often succeed in freeing themselves from the unhatched eggs of dipterous insects. (3) Certain parasites, which have made entrance into the body of the host but have not withdrawn completely into the body-cavity, are thrown off in molting. (4) The probability that the cuticula is some protection even against the well-developed ovipositor of hymenopterous parasites. It is contended that the marked parasitism to which insects are subject is not necessarily a proof of the inefficiency of the cuticula and a possible explanation can be found in the fact that a great many of the parasites

are themselves arthropods and that the arthropod structure and life history render the members of the group especially able to support parasitic invasions. "It seems highly probable that the cuticular armour, and the function of ecdysis correlated with it, in reality arrests a very considerable part of the violent attack which many members of the Arthropoda are obliged to sustain."

Polyhedral Bodies.—Glaser and Chapman ('16, Biol. Bull., 30:367-390) have studied the nature of the curious crystal-like structures called *polyhedral bodies* or *polyhedra* which are constantly associated with certain diseases of insects, known in America by the vernacular name *wilt*. The larval stages of thirteen species of *Lepidoptera,* belonging to eight different families, have been found to be susceptible to the polyhedral diseases, and at certain times these diseases kill off from 30 to 70 per cent. of some of the most noxious pests (gipsy-moth, tent-caterpillars, and army-worms). These structurally complicated polyhedra, which arise in the nuclei of certain tissue cells, are specific for a certain type of disease. They are "nucleoprotein crystal-like degeneration-products and not organisms."

Photosensitivity of Blowfly Larvæ.—Patten ('16, Journ. Exp. Zool., 20:585-598), in studying the changes of photosensitivity with age in the larvæ of *Calliphora erythrocephala,* tested the specimens daily, from hatching to pupation, by subjecting a larva, crawling under the influence of a horizontal beam of light, to an instantaneous change of 90° in the direction of the beam and measured the resulting change in the direction of locomotion. The curve of photosensitivity, constructed on individual averages, showed constant negative reaction and that increased amplitude occurred during the first days of larval life, the maximum of 81° being attained on the fourth day. Steady decrease followed until the seventh day and thence to pupation the amplitude remained almost constant. Decrease in sensitivity was coincident with the initiation of the migration period.

Chemotropic Response of House-fly.—Richardson ('16, Science, 43:613-616) experimented with a number of organic and inorganic compounds which occur as products of fermentation in barnyard manures in an effort to discover whether the distinct oviposition

preference of the house-fly for horse manure is due to the odor of some volatile chemical substance which was liberated in the manure during the early stages of decomposition. Ammonia was shown to be a strong alluring agent and was particularly attractive to the females. In experiments with acidulated manure, oviposition response was approximately in inverse ratio to the distance from the source of the ammonia. Butyric acid, and, to some extent, valerianic acid, augmented the oviposition response when added to moist ammoniated cotton. Ammonium carbonate and moist cotton lacking these acids produced no response. Since these acids are found in barnyard manure, the evidence points to them as the attracting agents for the fly.

Aquatic Lepidoptera.—Welch ('16, Annals Ent. Soc. Am., 9:159-190) reports on the biology of certain aquatic *Lepidoptera (Nymphula maculalis* and *N. icciusalis).* Eggs of *N. maculalis* are invariably deposited about the egg holes of a chrysomelid beetle *(Donacia)* in the floating leaves of the yellow water-lily. Laboratory experiments showed that in the absence of *Donacia* egg holes, egg masses of *N. maculalis* may be deposited, after some delay, about the leaf margin or artificial punctures and incisions. The orientation of the eggs in a mass is definite and constant. Tracheal gills are absent in the first instar but appear in the second. The total number of gill filaments per larva increases from forty in the second instar to over four hundred in the full-grown larva. Construction of cases from excised pieces of food plant leaves is a constant larval activity, these cases functioning as a protection and a support in water. Larval dissemination is accomplished by crawling, by voluntary propulsion in detached cases, by effects of winds, waves, and currents on detached cases, and indirectly by the work of certain other aquatic insects which separate the leaves of the food plant from the petiole. The larvæ and pupæ usually pass the entire existence under water. The adult is aerial and nocturnal. Eggs of *N. icciusalis* are laid on the margins of leaves of *Potamogeton natans* and independently of the activities of other aquatic animals. Tracheal gills are absent in all instars. Case-making, similar to that of *N. maculalis,* is a normal activity of the larva.

Syrphidæ.—Metcalf ('16, Maine Agr. Exp. Sta., Bull. 253),

in a study of the *Syrphidæ* of Maine, gives particular attention to the larvæ of these flies, treating of the structure and habits in considerable detail. Five different structural types of larvæ occur, the species of each having approximately the same habits: (1) the aphidophagous type, which is composed mainly of predaceous species; (2) the boring type, which includes the species that feed in the bulbs of living plants; (3) the short-tailed, filth-inhabiting type, which includes a number of species that feed on exposed decaying animal and vegetable matter; (4) the long-tailed, filth-inhabiting type, which is characterized by an elongate, posterior, flexible, telescoping, respiratory process at least half as long as the body; includes a number of forms which are scavengers in habit; and (5) the microdon type, includes those anomalous forms, sometimes mistaken for *Mollusca* and *Coccidæ,* which live in the nests of ants. Descriptions of the life stages and the life histories of the species of Maine are given and the beneficial and injurious habits of the larvæ discussed. Keys to the known larvæ and pupæ of *Syrphidæ* are included. Nine plates include a large number of figures of structural detail and life history stages.

Nematode Parasites.—Merrill and Ford ('16, Journ. Agr. Research, 6:115-127) found two new species of *Nematoda* parasitic in insects. *Diplogaster labiata* parasitizes the adults of *Saperda tridentata (Coleoptera),* infesting the digestive tract in such large numbers that they rupture the wall, escape into the body-cavity of the host, and cause its death. These nematodes were reared in water cultures to which macerated beetles were added as food, thus affording opportunity to work out the life history. Another nematode, *Diplogaster ærivora,* was found infesting the heads of termites *(Leucotermes lucifugus)* in numbers as high as 75 per host. They were found in the soil about infested termite colonies; also in the dead bodies of termites and other decaying matter. This parasite was successfully introduced into the termites. In cases of heavy infestation, the mortality of the host was high. *D. ærivora* was also reared in water cultures and the life history determined.

Cestodes in Musca domestica.—Gutberlet ('16, Journ. Am. Vet. Med. Assn., pp. 218-237) has carried on experiments which show that the cysticercoid stage of *Choanotænia infundibuliformis,*

a cestode which infests chickens, occurs in the common house-fly *(Musca domestica)*. Flies which fed on the eggs of this tapeworm developed the cysticercoid stage and chickens fed on flies developed the adult worm, the identity of the two stages being determined by morphological comparison. Circumstantial evidence points to the probability that certain other insects which commonly occur about poultry yards and which are readily eaten by fowls are the intermediate hosts of other species of cestodes.

Spermatogenesis in Dragon-flies.—Smith ('16, Biol. Bull., 31:269-303) describes spermatogenesis in the dragon-fly, *Sympetrum semicinctum,* and for comparison has examined another dragon-fly, *Libellula basalis.* The maturing sex cells in the testes of the nymphs occur in globular cysts arranged, one or two layers deep, around a central duct which extends zig-zag through each organ. The cysts seem to have no definite arrangement in the tubule according to age but all of the developing stages of the spermatozoa may be found in a single transverse section. In both species, there are 25 spermatogonial chromosomes which are so closely crowded together that they are difficult to study. Apparently, the leptotene threads unite side by side to form a spireme which breaks up into segments that seem to open out along the original axis of synapsis to form rings. These rings condense into crosses and then into quadripartite bodies or prophase chromosomes. Twelve bivalent autosomes and one sex-chromosome occur in the primary spermatocyte. In the second spermatocyte division, the sex-chromosome passes to one pole undivided, thus giving rise to two kinds of spermatids and subsequently to two kinds of spermatozoa. In *Libellula basalis,* the sex-chromosome passes undivided to one pole in the primary spermatocyte division, thus forming two kinds of secondary spermatocytes, while in the secondary division, it divides equally. Two kinds of spermatozoa are also produced but by a slightly different process.

Insect and Mite Galls.—Wells ('16, Ohio Journ. Sci., 16:249-290) has made a survey of insect and mite galls on the hackberry *(Celtis occidentalis),* giving particular attention to the histology of the galls and the gall bearing parts. The seventeen species of zoocecidia found were distributed as follows: *Acarinæ* 1, *Lepidop-*

tera 1, *Hemiptera* 5, *Diptera* 10. All produce abnormal cell and tissue formations. The acarinous and lepidopterous galls are *kataplasmas* (cells and tissues differing but slightly from the normal), while the hemipterous and dipterous galls are *prosoplasmas* (cells and tissues differing fundamentally from the normal ones). The latter show definite specificity. Eight plates containing many figures of these galls and their morphological characters accompany the paper.

Viability of Mosquitoes.—Chidester and Patterson ('16, Ent. News, 37:272-274), in an experimental study of the influence of various concentrations of sea water on the viability of the salt marsh mosquitoes, *Aëdes sollicitans* and *Aëdes cantator,* find that under laboratory conditions the viability of the larvæ in salt water depends upon the salinity of the water from which they are taken and varies with the species. Larvæ of *A. cantator* died quickly in distilled water and in the higher percentages of salinity. All larvæ in water of 22 per cent. or above died within two days. Field records indicate that *A. sollicitans* lives and thrives in marsh water of a higher salinity than that which appears to be suitable for *A. cantator.* Evidence seems to indicate that the distribution and date of appearance of the two dominant species are, in part, dependent upon the salinity of the marsh water at various distances from the sea. It is suspected that investigation will show a certain amount of dissolved salt more favorable for the development of the eggs of one species than another.

Gregarines of Insects and Myriapods.—Watson ('16, Illinois Biol. Monographs, 2:1-258) reports the results of a study of the gregarines found as parasites in various *Orthoptera, Coleoptera,* and *Myriapoda.* Although primarily a work on gregarines, it contains much of interest to entomologists, since considerable attention was given to the relations of these parasites to their arthropod hosts. Twenty-two new species are described and additional data are given for many others. The paper includes a synopsis of the eugregarine records of the *Myriapoda, Coleoptera,* and *Orthoptera* of the world; also a list of the cephaline gregarines of the world and their hosts, followed by a second list arranged according to the hosts. Records of two hundred forty-three gregarines distributed among

two hundred seventy-six hosts are given, these numbers including a few incomplete identifications. A valuable bibliography and fifteen plates containing three hundred thirty-eight figures are included in the paper.

Pupæ of Lepidoptera.—Mosher ('16, Bull. Ill. State Lab. Nat. Hist., 12:17-159) has presented an extensive paper on the "Classification of the Lepidoptera based on Characters of the Pupa." The external morphology of lepidopterous pupæ is worked out in detail. The paper is rich in analytical tables to the superfamilies, families, subfamilies, and genera. Full descriptions and discussions of the various groups are given. Attention was given to the phylogeny of the order, using the following characters as the basis: the number of movable segments; the freedom of the appendages; the number of sutures in the head; the relative length of the body segments; the presence or absence of visible labial and maxillary palpi; the presence of exposed portions of the prothoracic femora in specialized pupæ; and the method of dehiscence. The nature of the paper makes impossible a summary here, but it is the most comprehensive and connected study of lepidopterous pupæ which has appeared and forms an important basis for work on these quiescent stages.

Classification of Pupæ.—Mosher ('16, Annals Ent. Soc. Am., 9:136-158) reports on the classification of the pupæ of the saturniid moths *(Saturniidæ)*. The general characters of the pupæ of this family are described and a key to nine genera is given. Keys to certain species are also included. Detailed generic and specific descriptions are given for the pupæ of the following: *Copaxa lavendera, Telea polyphemus, Trophæa luna, Agapema galbina, Callosamia promethia, Callosamia angulifera, Eupackardia calleta, Rothschildia orizaba, Rothschildia jorulla, Samia californica, Samia cecropia, Samia columbia, Samia gloveri,* and *Philosamia walkeri.*

Breeding Habits of Orthoptera.—Turner ('16, Annals Ent. Soc. Am., 9:117-135) has made a survey of the breeding habits in the *Orthoptera* and finds that preliminary copulatory movements are, within narrow limits, constant for each group of this order but vary from very simple ones in *Mantidæ, Phasmidæ,* and *Acrididæ* to complex ones in *Blattidæ, Gryllidæ,* and *Locustidæ.* All males show sex discrimination but the females are aggressive and show sex

discrimination only in some groups while in others they are entirely passive. Habits of copulation are typical for each family, e. g., in *Mantidæ, Phasmidæ,* and *Acrididæ* there is superposition of the body of the male; in *Blattidæ* and *Gryllidæ* superposition of the female occurs; and in *Locustidæ* end to end copulation is characteristic. Generalized reproductive behavior occurs in those families having the largest number of subfamilies. A significant parallelism between a classification based on reproductive behavior and one based upon palæontological evidence occurs, suggesting "that the different types of reproductive behavior have been fairly constant since their origin."

Brain of Termites.—Thompson ('16, Journ. Comp. Neurology, 26:553-603) has made a study of the brain of *Leucotermes flavipes* (termite) in the different castes, with reference to its finer structure, making, in addition, a comparison with corresponding organs in the castes of true ants. This comparison is interesting since both termites and ants have a complex social organization but differ in degree of specialization and intelligence. The study included the nymphs of the first and second form, the soldier, the worker, and the true adult. No sex differentiation occurs between the brains of the different castes or stages and but very little caste differentiation appears, although the optic apparatus shows a correlation between the degree of development of the compound eyes and the size of the optic lobes. The structure of the brain in termites resembles very closely that of ants, except that the mushroom bodies are much simpler and more primitive. The ocelli, present in the nymphs and adults of the sexual forms but absent in the worker or soldier, are simple, primitive, without lens or pigment, and lack the ocellar lobes of the ocellar nerves which occur in ants. The problematical frontal gland, found in all castes and situated on the postero-dorsal surface of the brain between the mushroom bodies, is composed of epithelial cells continuous with the hypodermis and innervated from the brain. It seems to be functional only in the true adult and soldiers. "The suggestion is made that the frontal gland may have arisen phylogenetically from the ancestral medial ocellus which is now lacking in the

termites, and that the 'fontanel' nerve may be a vestige of the former median ocellar nerve."

Reflex "Bleeding."—McIndoo ('16, Annals Ent. Soc. Am., 9:201-222) finds that the "reflex bleeding" (the ejection of drops of liquid from the femoro-tibial articulations in certain coccinellid and meloid beetles) is a true reflex in *Epilachna borealis,* one of the *Coccinellidæ,* but that the liquid, instead of being blood, is a secretion from hypodermal glands and passes to the exterior through innumerable tubes opening near and in the articular membrane. Hypodermal glands are distributed widely over the integument of this species, groups of them occurring on the tarsi and around the femoro-tibial articulations, two at the proximal end of the tibia and two at the distal end of the femur. All four contain about 100 pores. The articular membrane contains about four hundred pores of still another kind. Fluid is emitted from these groups of pores in response to irritation. The discharge of the secretion is accomplished by muscular contraction in the femur whereby the blood is forced into a specially devised chamber containing the glands. The glands associated with the femoro-tibial articulation lack the reservoirs which characterize those glands distributed widely over the body. The secretion is bitter and disagreeable in odor. Its function is thought to be that of protection and it is suggested that possibly it aids in sex recognition and in distinguishing between different individuals.

Effect of Röntgen Rays.—Runner ('16, Journ. Agr. Research, 6:383-388) has experimented with the effect of Röntgen rays on the tobacco, or cigarette, beetle *(Lasioderma serricorne),* using a new form of Röntgen tube designed by Coolidge. Heavy dosages are demanded in the treatment of cigars or tobacco infested with this insect. Heavier exposures must be used for eggs near the hatching point than for those recently laid. Dosage equivalent to 150 milliampere minutes exposure with spark gap of 5.5 inches gave satisfactory results with eggs in tobacco placed 7.5 inches from the focal spot of the tube. Under this exposure, eggs in an advanced stage of development hatched but all observed specimens failed to reach the adult stage. Adults submitted to an exposure of 600 milliampere minutes, with spark gap of 5.5 inches, "giving

an approximate voltage of 65,000," and distance from focal spot of tube being 7.5, apparently lived the usual length of time but the large number of eggs deposited after exposure were infertile. Larvæ, receiving the same treatment, showed decreased activity and development, remaining in a dormant condition for a considerable period, and all died before reaching the pupal stage.

Parasitized Larvæ of Army-worm.—Tower ('16, Journ. Agr. Research, 6:455-458), in a comparative study of the amount of food eaten by parasitized and nonparasitized larvæ of *Cirphis unipuncta,* has found that when attacked by an internal parasite *(Apanteles militaris),* the parasitized larvæ of the army-worm ate approximately half as much food as unparasitized larvæ during corresponding periods, indicating that the parasitism becomes directly beneficial in the generation attacked. Four newly molted fifth-stage specimens when parasitized ate respectively 16.21, 12.16, 11.97, and 14.50 square inches of corn foliage during the last two stages previous to the emergence of the parasites while the average of twenty nonparasitized larvæ during the same stages was 33.6 square inches. Five partially developed fourth-stage larvæ when parasitized ate respectively 20.63, 17.36, 21.24, 17.64, and 17.99 square inches, while twenty nonparasitized larvæ ate, on the average, 34.77 square inches during the same stages.

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